

Competencies for Secondary Teachers: Mathematics Grades 7-12

2013

In addition to the Arkansas Teaching Standards, the teacher of Mathematics, grades 7-12, shall demonstrate knowledge and competencies in the following areas:

<p>1. Mathematical Practices</p> <p>CCSS-M Mathematical Practices 1-8</p> <p>Praxis II(0061/5061): Process Categories</p>	<p>Standard 1 – to be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know how to develop student expertise in the content area incorporating the following Standards for Mathematical Practice throughout all 7-12 mathematics by</p> <ul style="list-style-type: none"> 1.1 Making sense of problems and persevere in solving them 1.2 Reasoning abstractly and quantitatively 1.3 Constructing viable arguments and critiquing the reasoning of others 1.4 Modeling with mathematics 1.5 Using appropriate tools strategically 1.6 Attending to precision 1.7 Looking for and making use of structure 1.8 Looking for and expressing regularity in repeated reasoning
<p>2. Number and Quantity</p> <p>NCTM: A.1.1 - A.1.5</p> <p>CCSS: Math.Content.HSN</p> <p>Praxis II(0061/5061): I, II-M</p>	<p>Standard 2 - to be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to number and quantity with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by</p> <ul style="list-style-type: none"> 2.1 Knowing structure, properties, relationships, operations, and representations including standard and non-standard algorithms, of numbers and number systems including integer, rational, irrational, real, and complex numbers 2.2 Knowing fundamental ideas of number theory (divisors, factors and factorization, primes, composite numbers, greatest common factor, least common multiple, and modular arithmetic) 2.3 Knowing quantitative reasoning and relationships that include ratio, rate, and proportion and the use of units in problem situations 2.4 Knowing vector and matrix operations, modeling, and applications 2.5 Knowing historical development and perspectives of number, number systems, and quantity including contributions of significant figures and diverse cultures

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<p>3. Algebra</p> <p>NCTM/NCATE: A.2.1 - A.2.5</p> <p>CCSS: Math.Content.HSA</p> <p>Praxis II(0061/5061): I, II-M, II-G, II-T, III-F, V-M, V-D</p>	<p>Standard 3 - to be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to algebra with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by</p> <p>3.1 Knowing algebraic notation, symbols, expressions, equations, inequalities, and proportional relationships, and their use in describing, interpreting, modeling, generalizing, and justifying relationships and operations</p> <p>3.2 Knowing function classes including polynomial, exponential and logarithmic, absolute value, rational, and trigonometric, including those with discrete domains (e.g., sequences), and how the choices of parameters determine particular cases and model specific situations</p> <p>3.3 Knowing functional representations (tables, graphs, equations, descriptions, recursive definitions, and finite differences), characteristics (e.g., zeros, intervals of increase or decrease, extrema, average rates of change, domain and range, and end behavior), and notations as a means to describe, reason, interpret, and analyze relationships and to build new functions</p> <p>3.4 Knowing patterns of change in linear, quadratic, polynomial, and exponential functions and in proportional and inversely proportional relationships and types of real-world relationships these functions can model</p> <p>3.5 Knowing linear algebra including vectors, matrices, and transformations</p> <p>3.6 Knowing abstract algebra, including groups, rings, and fields, and the relationship between these structures and formal structures for number systems and numerical and symbolic calculations</p> <p>3.7 Knowing historical development and perspectives of algebra including contributions of significant figures and diverse cultures</p>
<p>4. Geometry and Trigonometry</p> <p>NCTM: A.4.1 - A.3.10</p> <p>CCSS: Math.Content.HSG</p> <p>CCSS: Math.Content.HSF.TF</p> <p>Praxis II(0061/5061): II-M, II-G,</p>	<p>Standard 3 - to be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to geometry and trigonometry with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by</p> <p>4.1 Knowing core concepts and principles of Euclidean geometry</p>

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II-T, V-M,	<p>in two and three dimensions and two-dimensional non-Euclidean geometries</p> <p>4.2 Knowing transformations including dilations, translations, rotations, reflections, glide reflections; compositions of transformations; and the expression of symmetry in terms of transformations</p> <p>4.3 Knowing congruence, similarity and scaling, and their development and expression in terms of transformations</p> <p>4.4 Knowing right triangles and trigonometry</p> <p>4.5 Knowing application of periodic phenomena and trigonometric identities</p> <p>4.6 Knowing identification, classification into categories, visualization, and representation of two- and three-dimensional objects (triangles, quadrilaterals, regular polygons, prisms, pyramids, cones, cylinders, and spheres)</p> <p>4.7 Knowing formula rationale and derivation (perimeter, area, surface area, and volume) of two- and three-dimensional objects (triangles, quadrilaterals, regular polygons, rectangular prisms, pyramids, cones, cylinders, and spheres), with attention to units, unit comparison, and the iteration, additivity, and invariance related to measurements</p> <p>4.8 Knowing geometric constructions, axiomatic reasoning, and proof</p> <p>4.9 Knowing analytic and coordinate geometry including algebraic proofs (e.g., the Pythagorean Theorem and its converse) and equations of lines and planes, and expressing geometric properties of conic sections with equations</p> <p>4.10 Knowing historical development and perspectives of geometry and trigonometry including contributions of significant figures and diverse cultures</p>
<p>5. Statistics and Probability</p> <p>NCTM: A.4.1 - A.4.6</p> <p>CCSS: Math.Content.HSS</p> <p>Praxis II(0061/5061): II-M, IV-D, IV-P</p>	<p>Standard 3 - to be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to statistics and probability with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by</p> <p>5.1 Knowing statistical variability and its sources and the role of randomness in statistical inference</p> <p>5.2 Creating and implementing of surveys and investigations using sampling methods and statistical designs, statistical inference</p>

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	<p>(estimation of population parameters and hypotheses testing), justification of conclusions, and generalization of results</p> <p>5.3 Knowing univariate and bivariate data distributions for categorical data and for discrete and continuous random variables, including representations, construction and interpretation of graphical displays (e.g., box plots, histograms, cumulative frequency plots, scatter plots), summary measures, and comparisons of distributions</p> <p>5.4 Knowing empirical and theoretical probability (discrete, continuous, and conditional) for both simple and compound events</p> <p>5.5 Knowing random (chance) phenomena, simulations, and probability distributions and their application as models of real phenomena and to decision making</p> <p>5.6 Knowing historical development and perspectives of statistics and probability including contributions of significant figures and diverse cultures</p>
<p>6. Calculus</p> <p>NCTM: A5.1-5.6</p> <p>Praxis II(0061/5061): II-M, III-C</p>	<p>Standard 6 - to be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to calculus with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models by</p> <p>6.1 Knowing limits, continuity, rates of change, the Fundamental Theorem of Calculus, and the meanings and techniques of differentiation and integration</p> <p>6.2 Knowing parametric, polar, and vector functions</p> <p>6.3 Knowing sequences and series</p> <p>6.4 Knowing multivariate functions</p> <p>6.5 Knowing applications of function, geometry, and trigonometry concepts to solve problems involving calculus</p> <p>6.6 Knowing historical development and perspectives of calculus including contributions of significant figures and diverse cultures</p>
<p>7. Discrete Mathematics</p> <p>NCTM: A.6.1 - A.6.5</p> <p>Praxis II(0061/5061): II-M, V-D</p>	<p>Standard 7 - to be prepared to develop student mathematical proficiency, all secondary mathematics teachers should know the following topics related to discrete mathematics with their content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete</p>

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	<p>models by</p> <p>7.1 Knowing discrete structures including sets, relations, functions, graphs, trees, and networks</p> <p>7.2 Knowing enumeration including permutations, combinations, iteration, recursion, and finite differences</p> <p>7.3 Knowing propositional and predicate logic</p> <p>7.4 Knowing applications of discrete structures such as modeling and solving linear programming problems and designing data structures</p> <p>7.5 Knowing historical development and perspectives of discrete mathematics including contributions of significant figures and diverse cultures</p>
<p>8. Disciplinary Literacy</p> <p>CCSS-ELA</p>	<p><u>Reading in Science and Technical Subjects, Grades 7-12</u></p> <p>Reading competencies for literacy in science and technical subjects for grades 7-12 include the ability to read informational texts in science and technical subjects closely and critically to analyze the key ideas and details as well as craft and structure with the purpose of integrating knowledge and ideas both within and across texts by</p> <p>8.1 Citing specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account</p> <p>8.2 Determining the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms</p> <p>8.3 Following precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyzing the specific results based on explanations in the text</p> <p>8.4 Determining the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 7-12 text and topics</p> <p>8.5 Analyzing how the text structures information or ideas are organized into categories or hierarchies, demonstrating understanding of the information or ideas</p> <p>8.6 Analyzing the author's purpose in providing an explanation,</p>

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	<p>describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved</p> <p>8.7 Integrating and evaluating multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem</p> <p>8.8 Evaluating the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information</p> <p>8.9 Synthesizing information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible</p> <p>8.10 Reading and comprehending a variety of scientific and technical documents appropriate for instruction within the 7-12 text complexity band</p> <p><u>Writing in History/Social Studies, Science, and Technical Subjects, Grades 7-12</u></p> <p>Writing competencies for literacy in history/social studies, science, and technical subjects for grades 7-12 will be demonstrated by</p> <p>8.11 Writing arguments focused on discipline-specific content by</p> <ul style="list-style-type: none"> • Introducing precise, knowledgeable claim(s), establishing the significance of the claim(s), distinguishing the claim(s) from alternate or opposing claims, and creating an organization that logically sequences the claim(s), counterclaims, reasons, and evidence • Developing claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. • Using words, phrases, and clauses as well as varied syntax to link the major sections of the text, creating cohesion, and clarification of the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. • Establishing and maintaining a formal style and objective
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	<p>tone while attending to the norms and conventions of the discipline in which they are writing.</p> <ul style="list-style-type: none"> • Providing a concluding statement or section that follows from or supports the argument presented <p>8.12 Writing informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes by</p> <ul style="list-style-type: none"> • Introducing a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting(e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension • Developing the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic • Using varied transitions and sentence structures to link the major sections of the text, creating cohesion, and clarifying the relationships among complex ideas and concepts • Using precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; conveying a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers • Providing a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic) <p>8.13 Producing clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience</p> <p>8.14 Developing and strengthening writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience</p> <p>8.15 Using technology, including the Internet, to produce, publish, and update individual or shared writing products in response to</p>
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	<p>ongoing feedback, including new arguments or information</p> <p>8.16 Conducting short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation</p> <p>8.17 Gathering relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrating information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation</p> <p>8.18 Drawing evidence from informational texts to support analysis, reflection, and research</p> <p>8.19 Writing routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences</p>
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